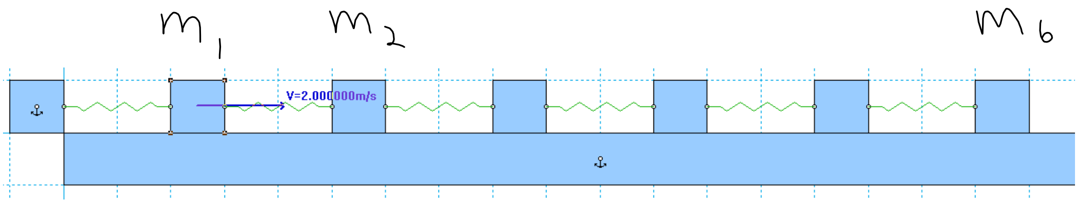


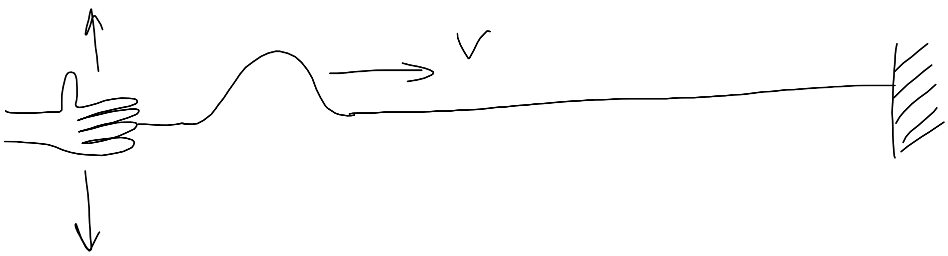
longitudinal wave

m6 does not move immediately

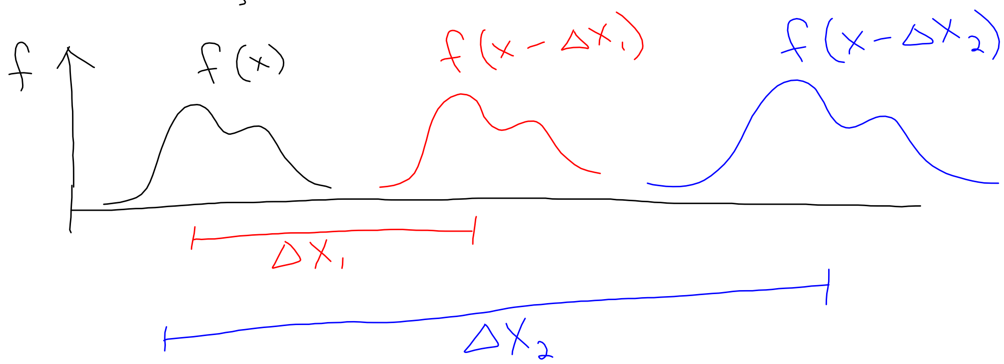
i.e. it takes time for the disturbance to propagate

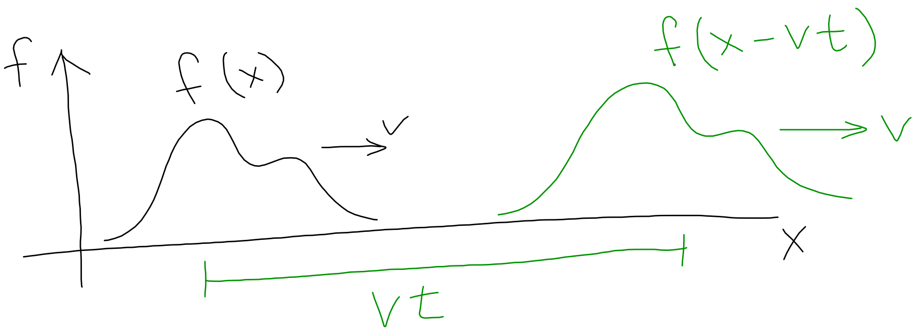
$$\text{velocity of disturbance} = \frac{\text{distance between } m_1 \;\&\; m_2}{\text{time before } m_6 \text{ starts moving}}$$

Another example: transverse wave



Traveling waves: (review)





Waves are functions of space and time that can be written:

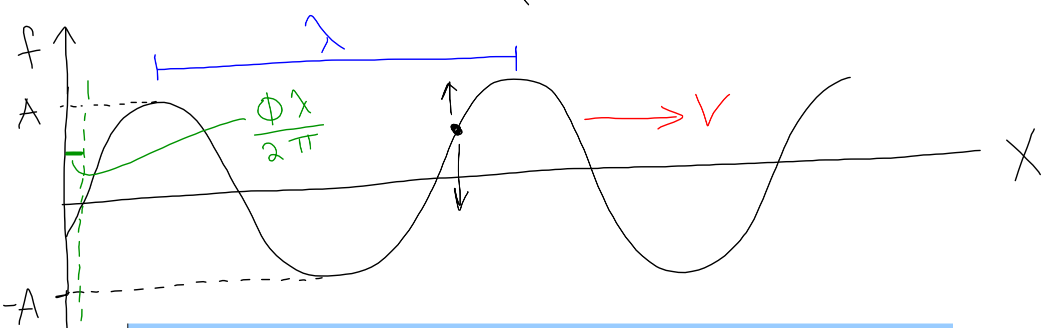
$$f(x \pm vt)$$

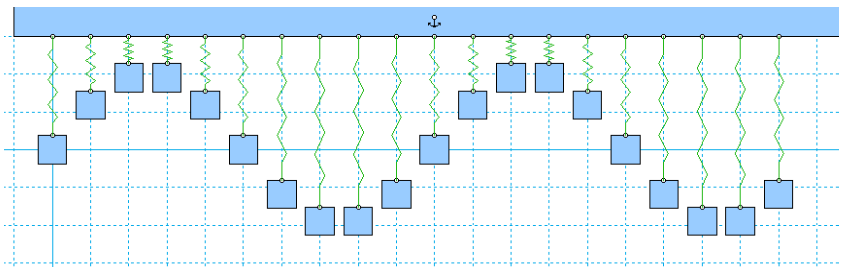
+ : propagating left

− : propagating right

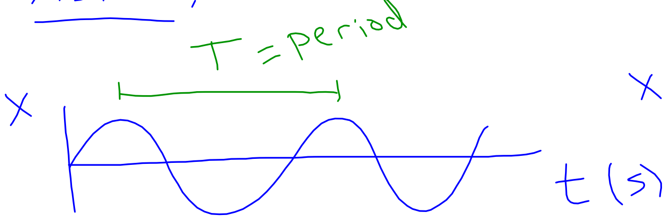
Most popular wave - sinusoidal wave

$$f(x,t) = A\sin\left(\frac{2\pi}{\lambda}(x - vt) + \phi\right)$$

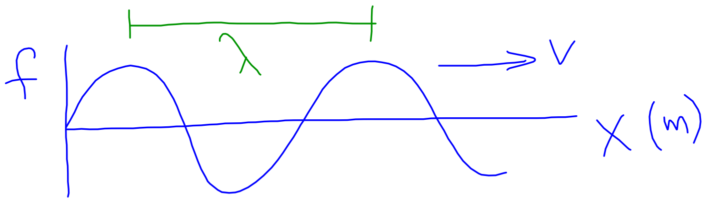




Aside:

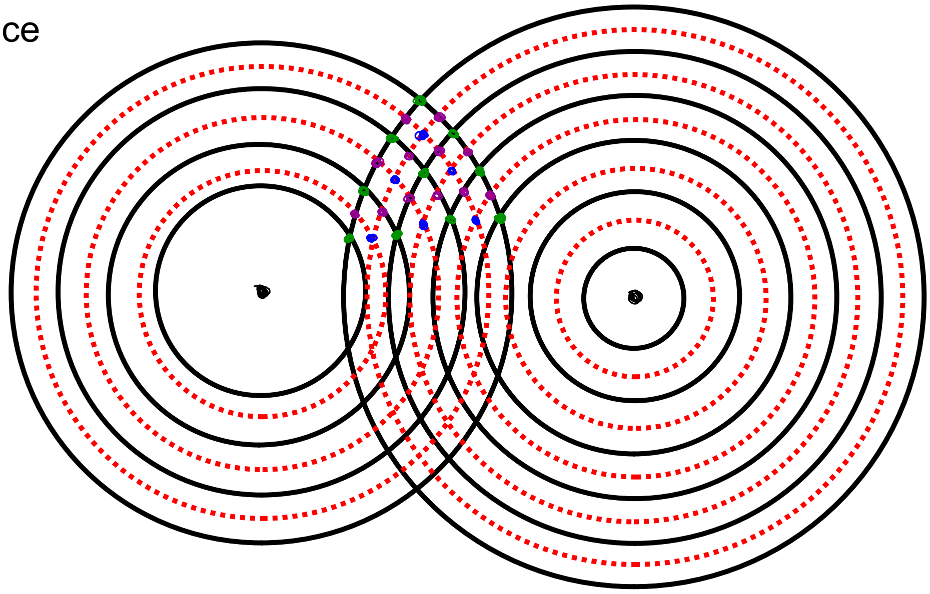


$$x(t) = x_{max} \sin\left(\frac{2\pi}{T} t\right)$$



$$f = f_{max} \sin\left(\frac{2\pi}{\lambda}(x - vt)\right)$$

Wave interference



When a peak meets a peak: constructive interference - amplitudes combine

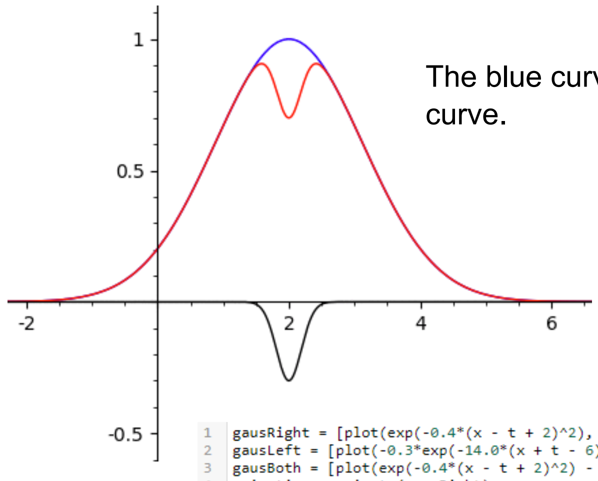
(green dots)

When a valley meets a valley: (negative) constructive interference - (negative) amplitudes combine

(blue dots)

When a peak meets a valley: destructive interference - amplitudes (partially) cancel out

(purple dots)



The blue curve and black curve interfere and you get the red curve.

```
gausRight = [plot(exp(-0.4*(x - t + 2)^2), (-4, 8), ymin=-1, ymax=1.2) for t in sxrange(0, 8, 0.1)]
gausLeft = [plot(-0.3*exp(-14.0*(x + t - 6)^2), (-4, 8), color="black") for t in sxrange(0, 8, 0.1)]
gausBoth = [plot(exp(-0.4*(x - t + 2)^2) - 0.3*exp(-14.0*(x + t - 6)^2), (-4, 8), color="red") for t in sxrange(0, 8, 0.1)]
animation = animate(gausRight)
animation += animate(gausLeft)
animation += animate(gausBoth)
animation.show(delay=10)
```